

# Researchers couple then decouple overlapping memories in mice

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(Medical Xpress)—A team of researchers at the University of Toyama in Japan has found a way to uncouple overlapping memories in mice. In

their paper published in the journal *Science*, the researchers describe how they induced two separate memories in test mice, how they caused the two memories to overlap and then how they decoupled them without erasing either

Scientists know that there are many types of memories, some of which can overlap. If you learn to avoid a certain type of sweetener, for example, and have also discovered how much it hurts to pinch your finger in the refrigerator door, you could find those memories overlapping if they occur simultaneously a few times, which could cause you to wince the next time you accidentally swallow a drink with the undesired sweetener in it. In this new effort, the researchers describe an experiment they conducted where they caused such an overlapped [memory](#) in mice to no longer overlap, without changing either memory.

The experiment consisted of inducing bad memories of tasting saccharine in several test mice—each time they did so, they received an injected dose of lithium chloride which caused them to feel sick. Several days later, the same mice were given a little shock whenever they heard a certain tone, building a bad memory of the tone. Next, the mice were given a food to lick that contained saccharine at the same time the tone was played. This caused the mice to connect the two memories, making them overlap.

Thereafter, when tasting saccharin, they froze as if expecting a shock. As the experiment continued, the researchers identified the groups of neurons in the mice that were responsible for holding the two [new memories](#), and then for the neurons responsible for holding information about the overlap. Once the mice were all trained, the researchers used optogenetics to turn the overlapping cells on and off. Turning them off, they found, removed the overlapping memory—the [mice](#) no longer froze when tasting the saccharin. But they still remembered the unpleasant aspect associated with tasting it and the electric shock that went along

with the tone. Turning the overlapping neurons back on caused the overlapping memory to return.

The [researchers](#) suggest that in addition to offering new insights into how memory works in mammals, the results also suggest it might one day be possible to remove overlapping memories in people that cause problems, such as with PTSD.

**More information:** Jun Yokose et al. Overlapping memory trace indispensable for linking, but not recalling, individual memories, *Science* (2017). [DOI: 10.1126/science.aal2690](https://doi.org/10.1126/science.aal2690)

## Abstract

Memories are not stored in isolation from other memories but are integrated into associative networks. However, the mechanisms underlying memory association remain elusive. Using two amygdala-dependent behavioral paradigms—conditioned taste aversion (CTA) and auditory-cued fear conditioning (AFC)—in mice, we found that presenting the conditioned stimulus used for the CTA task triggered the conditioned response of the AFC task after natural coreactivation of the memories. This was accompanied through an increase in the overlapping neuronal ensemble in the basolateral amygdala. Silencing of the overlapping ensemble suppressed CTA retrieval-induced freezing. However, retrieval of the original CTA or AFC memory was not affected. A small population of coshared neurons thus mediates the link between memories. They are not necessary for recalling individual memories.

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